2004 GALVESTON BAY INVASIVE SPECIES RISK ASSESSMENT
INVASIVE SPECIES SUMMARY
Created by: Environmental Institute of Houston, University of Houston-Clear Lake
and the Houston Advanced Research Center

Common Name: Blue tilapia

Latin Name: *Oreochromis aureus*

Category: Animal

Place of Origin: "The origin of the U.S. stocks of *O. aureus*, imported as *Tilapia nilotica*, was Israel (Courtenay and Hensley 1979a).

The overall native range is tropical and subtropical Africa, and Middle East. Native range includes Senegal, Niger, and many smaller drainages and lakes in Africa and Middle East (Trewavas 1983a; Skelton 1993)

http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html

Place of Introduction: "This species (often identified as *Tilapia nilotica*) was stocked annually by the Alabama Department of Conservation and Auburn University in lakes and farm ponds in Alabama during the late 1950s, 1960s, and 1970s (Rogers 1961; Smith-Vaniz 1968; Habel 1975).

Established or possibly established in ten states. Established in parts of Arizona, California, Florida, Nevada, North Carolina, and Texas. Possibly established in Colorado, Idaho, Oklahoma, and Pennsylvania. Reported from Alabama, Georgia, and Kansas. For more than a decade it has been considered the most widespread foreign fish in Florida (Hale et al. 1995) (http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html)."

Date of Introduction: Repeatedly stocked (in Alabama, and elsewhere) during the 1950s, 1960s, and 1970s. (Rogers 1961; Smith-Vaniz 1968; Habel 1975; Hale et al. 1995).http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html

Life History: "Blue tilapia are mouth brooders. Males construct nests and defend territories, and females mouth brood the young (Buntz and Manooch, 1968). McBay (1961) reported nest building in Alabama ponds, in shallow waters of sandy substrate, at about 60 cm in depth. Males defended their territories through ritualized displays and mouth fighting. After fertilization of the eggs spawned in the male's nest, females pick up the eggs with their mouths and head to deeper waters to mouth brood the young (McBay, 1961). Females become mature at about 100 mm, with reports of females as small as 58 mm with ripe ovaries over their native range (Chervinsky in Trewevas, 1983).

Payne and Collinson in Trewevas (1983) reported fecundity varying between 350-1600 eggs per female in Lake Menzaleh. McBay(1961) reported fecundities of between 160-462 eggs for females between 125 and 175 mm, under experimental conditions. Blue tilapia appear to require a minimum temperature of 20-22°C to breed (McBay, 1961; Trewevas, 1983), which seasonally limits their breeding in the Gulf states (http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html)."

Growth/Size: 51 cm (Lee et al. 1980 et seq.).

Feeding Habits/Diet: "Adults are mostly herbivorous, feeding primarily on phytoplankton and epiphytic algae, but occasionally taking zooplankton (Lee et al., 1980). Juveniles feed mostly on zooplankton and small arthropods (McBay, 1961; Buntz and Manooch, 1968; Trewevas, 1983). Spataru and Zorn (1978), however, reported this species as mostly zooplanktivorous in Lake Kinneret, Israel, taking plant matter and algae as secondary food sources. Occasionally small fish are also taken (McBay, 1961). Gregory (1990), reported juveniles show some preference for rotifers, cladocerans, and *Bosmina*, in Lake Georgia, Florida (http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html)."

Habitat: "Salinity Tolerance: Blue tilapia are found mostly in fresh waters, but occur in brackish estuaries and rarely marine waters also (Shafland and Pestrak, 1982; Trewevas, 1983). Lee et al. (1980) and Courtenay et al. (1984) reported breeding populations in saline waters of Tampa Bay, Florida.

Temperature Tolerance: Blue tilapia have a greater resistance to cold temperatures than most other non-indigenous cichlids present in the Gulf. This attribute is at least partially responsible for their broad distribution in the Gulf of Mexico ecosystem (Courtenay et al., 1984; Shafland, 1996). However, reports on their lower temperature tolerance are quite varied. Under experimental conditions Shafland & Pestrak (1982) reported a lower lethal temperature of 6.2°C. Chervinski and Lahav (1976), also under experimental conditions, reported a lower lethal temperature of between 9-11°C. In addition, these authors reported an increased cold tolerance at

low (5 ppt.) salinities, over that in fresh water. Lee et al. (1980) reported a lower temperature tolerance of 13°C. McBay (1961) reported juveniles as less tolerant to cold temperatures than adults. A minimum temperature of 20-22°C appears to be required for breeding, both over their native and introduced ranges (McBay, 1961; Trewevas, 1983). In the Gulf states, blue tilapia congregate into dense schools in thermal refuges during much of the winter (Buntz and Manooch, 1968; Howells, 1992) (http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html)."

Attitude (aggressive, etc.): "The blue tilapia is considered a competitor with native species for spawning areas, food, and space (Buntz and Manooch 1969; Noble and Germany 1986; Muoneke 1988; Zale and Gregory 1990). Courtenay and Robins (1973) reported that certain streams where this species is abundant have lost most vegetation and nearly all native fishes. It has invaded the Taylor Slough portion of Everglades National Park where it is considered a major management problem for the National Park Service (Courtenay 1989; Courtenay and Williams 1992). The blue tilapia's local abundance and high densities in certain areas have resulted in marked changes in fish community structure (Muoneke 1988, and citations therein). A dramatic reduction in native fishes in the Warm Springs area of Nevada coincided with invasion of this species (Scoppettone et al. 1998).

Blue tilapia have also been implicated as the cause for unionid mussel declines in two Texas water bodies, Tradinghouse Creek and Fairfield reservoirs (Howells 1995) (http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html)."

"Blue tilapia are one of the most common non-indigenous fish of the Gulf drainages, and the dominant species over much of their range. Native fish assemblages appear unable to control blue tilapia numbers either by competition or direct predation (Buntz and Manooch, 1968). Zale and Gregory (1990), reported overlap in diet of introduced juvenile blue tilapia with juvenile shad (*Dorosoma spp.*), and suggested competition for limited trophic resources, as a possible reason for the decline of local populations of shad in Florida. Buntz and Manooch (1968), reported competition in Florida between Blue tilapia and native centrarchids for breeding areas by adults, and trophic resources by juveniles. Besides directly competing for nesting areas with native fish, their aggressive behavior probably alters community structure where they are abundant (McBay, 1961). Noble et al. (1975), reported inhibition of largemouth bass breeding in the presence of high densities of blue tilapia, in the eutrophic waters of Lake Trinidad, Texas. The blue tilapia has undoubtedly displaced many native fish and contributed to lowering local biodiversity where common (http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html)."

Physical Description: "Blue tilapia have 18-26 gill rakers on the lower part of their first gill arch with distinct microbranchiospines present. They have 16 dorsal spines and 3 anal spines. The lower does not exceed 36.8% and the preorbital does not exceed 21.5% of the length of the head. The blade of the lower pharyngeal is short. The caudal fin has a broad pink to bright red distal margin. Breeding males have intense bright metallic blue on their head, a vermilion coloration on the edge on their dorsal fin and an intense pink coloration on the margin of their caudal fin. Breeding females have a paler orange coloration on the edges of their dorsal and caudal fins (Trewevas, 1983) (http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html)."

Management Recommendations / Control Strategies: include references for existing site-specific strategies

1. USFWS. 2002. Final Finding of no Significant Impact. Tilapia Removal Program on the Virgin River, Clark County, Nevada and Mohave County, Arizona. U.S. Fish and Wildlife Service. Ecological Services Southern Nevada Field Office Las Vegas, Nevada. October. FILE NO. PLAR_NEPA. http://nevadafwo.fws.gov/public/virginriverFONSI.pdf.

"We have determined that the Alternative One, the Piscicide, Detoxification Station, and Barrier Alternative, with the modifications and additions included in the Final EA will not result in significant impacts to the human and natural environment and would be the best alternative to meet the purpose and need as stated above. Therefore, an Environmental Impact Statement will not be prepared. An analysis of any additional anticipated environmental impacts resulting from the modifications and additions is included in Chapter Three of the Final EA."

References (includes journals, agency/university reports, and internet links):

1. http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html. USGS Nonindigenous Aquatic Species Profiles.

2. http://www.gsmfc.org/nis/nis/Oreochromis_aureus.html. Gulf of Mexico Non-Indigenous Species Summary.

3. Courtenay, W. R., Jr., and D. A. Hensley. 1979a. Survey of introduced non-native fishes. Phase I Report. Introduced exotic fishes in North America: status 1979. Report Submitted to National Fishery Research Laboratory, U.S. Fish and Wildlife Service, Gainesville, FL.

4. Trewavas, E. 1983. Tialpine fishes of the genera *Sarotherodon*, *Oreochromis* and *Danakilia*. Cornell University Press, Ithaca, NY.

5. Skelton, P. H. 1993. A complete guide to the freshwater fishes of southern Africa. Southern Book Publishers, Halfway House, South Africa.

6. Rogers, W. A. 1961. Second progress report on stocking and harvesting of tilapia and channel catfish in Alabama's state-owned and managed public fishing lakes. Federal Aid Project F-10. Alabama Department of Conservation. 10 pp.

8. Habel, M. L. 1975. Overwintering of the cichlid, *Tilapia aurea*, produces fourteen tons of harvestable size fish in a south Alabama bass-bluegill public fishing lake. Progressive Fish-Culturist 37:31-32.

9. Hale, M.M., J.E. Crumpton, R.J. Schuler, Jr. 1995. From sportfishing bust to commercial fishing boon: A history of the blue tilapia in Florida. American Fisheries Society Symposium 15:425-430.

10. Buntz, J., and C.S. Manooch, III. 1968. *Tilapia aurea* (Steindachner), a rapidly spreading exotic in south central Florida. Proc. SE Assoc. Game Fish Comm. 22:495-501.

11. McBay, L.G. 1961. The Biology of *Tilapia nilotica* Linnaeus. Proc. SE Assoc. Game and Fish Comm. 15: 208-218.

12. Chervinski, J., and M. Lahav. 1976. The effect of exposure to low temperature on fingerlings of local tilapia (*Tilapia aurea*)(Steindachner) and imported tilapia (*Tilapia vulcani*)(Trewevas) and *Tilapia nilotica* (Linne) in Israel. Bamidgeh 28(1/2):25-29.

13. Lee, D. S., C. R. Gilbert, C. H. Hocutt, R. E. Jenkins, D. E. McAllister, and J. R. Stauffer, Jr. 1980 et seq. Atlas of North American freshwater fishes. North Carolina State Museum of Natural History, Raleigh, NC.

14. Spataru, P., and M. Zorn. 1978. Food and feeding habits of *Tilapia aurea* (Steindachner) (Cichlidae) in Lake Kinneret (Israel). Aquaculture 13:67-79.

15. Shafland, P.L., and J.M. Pestrak. 1982. Lower lethal temperatures for fourteen non-native fishes in Florida. Environmental Biology of Fishes 7(2):149-156.

16. Courtenay, W. R., Jr., D.A. Hensley, J.N. Taylor, and J.A. McCann. 1984. Distribution of exotic fishes in the continental United States. Pages 41-77 in W.R. Courtenay, Jr., and J.R. Stauffer, Jr. Distribution, Biology and Management of Exotic Fishes. John Hopkins University Press. Baltimore.

18. Noble, R. L. and R. D. Germany. 1986. Changes in fish populations of Trinidad Lake, Texas, in response to abundance of blue tilapia. Pages 455-461 in R. H. Stroud, editor. Fish culture in fisheries management. American Fisheries Society, Bethesda, MD.

19. Muoneke, M. I. 1988. Tilapia in Texas waters. Texas Parks and Wildlife Department, Inland Fisheries Data Series 9, Austin, TX. 44 pp.

20. Zale, A. V., And R. W. Gregory. 1990. Food Selection By Early Life Stages Of Blue Tilapia, *Oreochromis Aureus*, In Lake George, Florida: Overlap With Sympatric Shad Larvae. Florida Scientist 53(2):123-129.

21. Courtenay, W. R., Jr., and C.R. Robins. 1973. Exotic aquatic organisms in Florida with emphasis on fishes: A review and recommendations. Transactions of the American Fisheries Society 102:1-12.

22. For additional references, see Annotated Bibliography.

Available Mapping Information:

1. USGS Nonindigenous Aquatic Species Profiles. http://nas.er.usgs.gov/fishes/accounts/cichlida/or_aureu.html

2. Historical Distribution of *Oreochromis aureus* in Non-Native Range.http://www.gsmfc.org/nis/nis/nnrange/Oreochromis_aureus_non-native_range.html